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TECHNICAL PROGRESS IN SOVIET POWER ENGINEERING

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Only the main achievements in the technical progress of Soviet electric-power production will be noted in this article.

At present, the main sources of electric power are steam-electric plants. In 1940, their output was about 90% of the total power production in the USSR. In 1950, despite an appreciable increase in the output of hydroelectric power, they still accounted for four-fifths of the total power production.

In future five-year plans, the output of hydroelectric power stations will show an annual increase, largely due to construction of the Stalingrad, Kuybyshev, Kakhovka, and other new high-power hydroelectric stations.

Use of Local Fuels

One of the most remarkable successes of Soviet power engineering is the utilization of local fuels made possible by progressive methods of preparation and combustion. Effective methods have been developed for combustion of over 60 types of fuel with the most diverse properties: high moisture content (up to 55%), high ash content (up to 60% of the dry mass), negligible yield of volatile gases (3% of the fuel mass), low ash melting point, high sulfur content, different caking characteristics, etc.

Utilization of local fuels was particularly important during World War II, when the USSR was obliged to do without Donets coal and convert many power installations to other types of fuel. It was only a few months, however, before the converted installations were operating reliably and economically on local fuels.

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Since the war, regional steam-electric power plants, operating on local fuels, have produced over 75% of the total electric power. Further improvements along these lines depend on better methods of ash and sulfur recovery, chemical utilization of various types of fuel in power stations, new methods of using ash as raw material for industry, etc.

Steam With High Initial Parameters

Another significant trend in Soviet power engineering is the introduction of steam with high initial pressures and temperatures. Conversion of electric power stations from an initial steam pressure of 15 atm and a temperature of 350° to 30 atm and 400° provides a 25-30% saving in fuel consumption. Conversion from 30 atm and 400° to 100 atm and 500° will effect a further saving of 13-14%. Even before the war, Soviet electric power stations were converted to the high-standard parameters of 29 atm and 400° (at the turbines).

Still another noteworthy Soviet achievement was an original uniflow boiler, designed in 1943 by L. K. Ramzin, for which he received a Stalin Prize.

During the postwar Stalin Five-Year Plan, Soviet plants have been building powerful boilers and turbines with initial steam pressures of 90-100 atm and temperatures of 480-500°. Theoretical and experimental work is now being conducted on converting to super-high initial parameters, i.e., 170-250 atm and 550-600°.

In prerevolutionary Russia, boilers did not produce more than 10 tons of steam per hour as compared with 230 tons per hour today, and the maximum power of turbines built by the Petersburg Metal Plant (now LMZ, the Leningrad Metal Plant imeni Stalin) was 1,200 kw. Until the revolution, only 26 turbines with a total power of 9,000 kw had been produced. Since then, turbogenerators with a power of 100,000 kw each have been put in operation. The 100,000-kw turbine produced by LMZ in 1938 - 1939 was the first high-speed, 3,000 rpm, two-cylinder /sic/ machine in the world.

In 1946, a 100,000-kw, single-shaft turbogenerator unit (3,000 rpm) was built by LMZ and the "Elektrosila" Plant. Its initial steam parameters were 90 atm and 480°. Its weight, 265 tons, was no greater than that of the 29-atm turbine with the same power output. For this machine the "Elektrosila" Plant built a hydrogen-cooled, 100,000-kw generator. The scientists, designers, and engineers of both plants were twice awarded a Stalin for this work.

Automatic Process Control

Automatic process control is being extensively introduced in power stations. Its use increases boiler efficiency by 2-3%, which would mean a saving of about 10,000 tons of fuel per year in a 200,000 kw station.

Several series of improved automatic devices, such as the VTI, TsKTI, the Teploavtomat, etc., have been manufactured for boiler operation. Complex automatic control of boilers includes automatic regulation of water supply, combustion, steam temperature, fuel delivery, etc. Two groups were awarded Stalin Prizes in 1946 and 1948 for designing automatic boiler controls and introducing them in industry.

Improvements are also being made for the electrical components of stations, e.g., protective relays, automatic repeated reclosing, automatic devices for switching in power reserves, etc.

During the postwar Five-Year Plan, considerable progress has been made in automatic control of steam-electric power stations, but the introduction of complex, automatic control in all steam-electric power stations is still one of the most urgent tasks of Soviet power engineers.

In recent years, the efficiency of steam-electric power stations has doubled, but there is room for further improvement, both in this respect and in reducing fuel consumption. Among such improvements are: new types of high-power boilers and steam turbines with super-high initial steam parameters; better control equipment for steam-electric power stations; use of mercury-vapor turbines in enterprises and electric power stations; use of gas turbines operating on solid fuel in low- or medium-power electric stations; greater utilization of waste heat in industrial enterprises; [redacted] of fuel in power stations; and new types of power circuits.

Hydroelectric Stations

Great progress has also been made in the development of hydroelectric stations. The first hydroelectric station in the USSR was the Volga, which began operation in 1926. It was followed by the Dnepr, Svir, Sherbakovo, and others. After the war, the [redacted]grad Metal and "Elektrosila" plants built hydraulic turbines (102,000 hp, efficiency 93%) and generators to re-equip the Dnepr station. The two groups responsible for this work were awarded a Stalin Prize in 1950.

Governmental plans call for completion within 5 years of a 2,000,000-kw hydroelectric station at Kuybyshev and a 1,700,000-kw station at Stalingrad. These stations will produce 20 billion kwhr per year. When they are in operation, the large systems of the Center (Tsentr), headed by the Moscow system, [redacted] and those of the Volga (from Kuybyshev to Astrakhan) and the central black-earth regions will be combined. To transmit power from these high-power stations to Moscow, distances of 800-1,000 km, 400-kv ac networks will be used.

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